



Introduction to the Human Factors Implementation Team (HFIT) Process for Payload Developers

***Presented by: Rich Ellenberger
Flight Crew Integration (FCI)***



Purpose and Background



Purpose

- Provide a background and overview of the Human Factors Implementation Team (HFIT) process.

Background and History

- The HFIT process was developed in 2003 to make Human Factors requirements integration and verification consistent across payloads, efficient, and successful for PDs and the ISS program.
 - Aids the PD in Human Factors requirements integration and compliance (SSP 57000 section 3.12).



Background



Background and History (cont.)

- HFIT results in elimination of costly International Space Station (ISS) Program paperwork for human factors exceptions
 - Before the HFIT process was established, 65% of board-processed exceptions were related to HF requirements.
 - With the HFIT process, HF requirements violations are either avoided, resolved, or at the least, minimized. Any unavoidable violations made known/vetted early with the HFIT team can be assessed, accepted and documented.
- HFIT results in hardware that is easier to safely operate
 - Improves safe and efficient human interaction with the hardware, which *facilitates on-orbit crew operations* and *improves science outcomes*.
 - Astronaut Office provides the operator feedback for hardware operability and crew tasks.
- **HFIT is optional, but virtually all PDs choose it because it's so beneficial**
 - HFIT Team identifies potential human factors or operational issues early so design changes can be made easily with little to no cost impact to ensure better requirements compliance at verification stage.
 - HFIT and the PD are usually able to agree on low cost solutions to meet requirements.



Requirements Update



RISE requirements reduction summary

- Significant **33%** reduction in total number of requirements (“Shalls”) and guidelines (“Shoulds”). [From 107 to 72]
 - Redundant requirements consolidated (e.g. captive parts, one-handed operation).
 - Deletions of unimportant (no consequence if don’t meet) or rarely applicable requirements (e.g. Audio Device Displays).
- Massive **76%** reduction in number of requirements (“Shalls”). [From 103 to 26]
 - Remaining 26 “Shalls” are required to be verified because they are **crew safety related** or needed to **prevent damage to neighboring hardware**.
- Number of guidelines (“Shoulds”) went from 4 to **46**.
 - Guidelines are not required to be met for approval. **PDs accept the risk to their mission success for not meeting guidelines.**
 - HFIT will still provide recommendations on meeting guidelines when they’re in the best interests of the payload’s success. We still want payloads to be successful.



HFIT Function



HFIT Tasks

- HFIT Team reviews available payload data and documents applicable requirements in “Human Factors Requirements Applicability and Compliance” (Form 881)
 - PD, Astronaut Office, and PIM concurrence (email-no signatures)
- Initial evaluation of Payload HW scheduled as early as possible
 - Venue can be SRR, PDR, hardware operations TIM, or similar milestone as coordinated by Payload Integration Manager (PIM).
 - Requirements applicability refined as knowledge of hardware increases.
 - HFIT conducts the evaluation with Astronaut Office support to exercise crew interfaces.
 - IPLAT (ISS Payload Label Approval Team) assessment can be done at the same time. HFIT coordinates with IPLAT.
 - Objective is to provide the PD an early snap-shot of design compliance.
 - Quick (within a week) constructive feedback provided to PD via Form 881.



HFIT Function



HFIT Tasks (cont.)

- Provide on-going support/feedback on requirements interpretation and compliance.
- Final HFIT evaluation to formally verify HF requirements
 - Conducted with HFIT rep, PD rep, and Astronaut Office rep at designated venue.
 - Can be done remotely in some cases for simple payloads.
 - HFIT coordinates with IPLAT on final label approval.
 - Any requirements violations are documented on the Human Factors Requirements Non-Compliance Acceptability Form, Form 882.
 - For minor, non-safety related issues, if HFIT and Astronaut Office accept them, Form 882 is signed.
- Close HFIT requirements
 - Provide PD with requirements verification documentation.
 - Signed HFIT Certificate of Compliance (CoC), with attached Form 882 if needed.
 - Document and Archive CoC with Program database, VERITAS.



Integration with Operations



New for 2016:

- There is a desire to perform HFIT evaluations and Operations Assessments at the same time, when possible.
 - Both HFIT and Ops Leads need much of the same data.
 - HFIT benefits from having draft procedures available for Astronaut Office rep to exercise crew interfaces to assess human factors requirements compliance.
 - Ops Lead benefits from the opportunity to refine procedures in person with the PD and Astronaut Office. Many times procedures comments (e.g. sequence of tasks) are made at an HFIT evaluation anyway.
 - Best use of PDs time to *“kill two birds with one stone”*; merge HFIT and Ops assessment into one event.
 - **Very PD-friendly and in the spirit of RISE to combine HFIT & Ops Assessments.**
- MSFC Operations Leads have an open invitation to attend any HFIT evaluation when possible.



eHFIT



New for 2016:

- eHFIT (separate presentation) will streamline the HFIT human factors verification process.



Crew Comments Resource for Payload Developers



- ❑ The FCI Operational Habitability (OpsHab) team collects, identifies and analyzes data from the ISS Post-Flight and On-Orbit Crew Debriefs, from 2-A to current E-39/40

- ❑ ***Confidential Crew Comments Data Base (CCDB) maintained by OpsHab:**
 - Contains more than 63,000 crew comments
 - Post-flight and on-orbit debriefs, 30+ ISS debrief systems
 - Searchable archive (SQL database), official source for all ISS Crew Debrief transcripts
 - Supports current and future program design and development of vehicles, hardware, requirements, procedures, issue resolution, lessons learned & trending

- ❑ ***Reports Generated by OpsHab** (Upon Request):
 - **Quick Request Reports:** Customizable report containing all available comments on a specific topic, keyword, or mission (e.g. US Payloads) or a specialized data set (e.g. individual payloads, Payload Training, crew time, etc.) across all debriefs
 - After request, Report delivery approximately 1 week, depending on complexity of search
 - All Reports are reviewed and approved by the Astronaut Office prior to dissemination

***Due to privacy agreements with the Astronaut Office, only the OpsHab team has access to directly search the CCDB and create Reports**



HFIT Points of Contact



Payload HFIT Lead

- Rich Ellenberger: 281.483.5238 (NASA FCI System Manager Deputy and Payload HF Lead)

Payload HFIT Representative

- Jason Beierle: 281.483.7919
- Jenae Aber (Lestishen): 281.226.5724 281-226-5724
- Chen Deng: 281.226.4264
- Antonius Widjokongko: 281.483.9717
- Wynona Johnson-McAfee: 281.483.8870
- Mai Lee Chang: 281.483.0685

Other FCI Contacts:

- Susan Schuh: 281.483.7487 (FCI OpsHab Lead for Database)
- Laura Duvall: 281.483.0244 (NASA FCI System Manager)



Questions?



Introduction to the ISS Payload Label Approval Team (IPLAT) Process for Payload Developers

***Presented by: Rich Ellenberger
ISS Flight Crew Integration***



Purpose and Background



Purpose

- Provide a background and overview of the ISS Payload Label Approval Team (IPLAT) process

Background and History

- IPLAT process was originally developed in 1999 as a mandatory process to facilitate the verification of IVA payload labeling requirements in Appendix C of SSP 57000 (new Appendix O in SSP 57000 Rev R). Similarly, IPLAT also covers EVA labeling (SSP 57003).
- SSP 57000 (3.12.7), contains a single label requirement and it points to label requirements in Appendix C (to become Appendix O).
- IPLAT prepares all needed verification paperwork and forwards signed Label Approval Form (2994) to formally document verification closure of all labeling requirements.
- HFIT and IPLAT work together as one team, although they are on separate contracts.



Labeling of Crew Interfaces



IPLAT must review all labels on Payload hardware/equipment that the crew will interface with (nominal operations, planned maintenance, contingency)

- **This includes, but is not limited to:**
 - Rack/subrack front panel type hardware
 - All experiment equipment, loose or mounted other than in rack/subrack formation
 - All equipment cables, fluid lines, hoses, etc.
 - All equipment controls, switches, ports, LEDs, containers, etc
- **This does not include:**
 - Items which the crew will not interface with (e.g. internal circuit boards, etc.)
 - Labels contained within software displays. These are handled by the Payload Display Review Team (PDRT).
 - Procedures, Cue Cards, etc. These are handled by the Payload Operations Data File (PODF).



Standard IPLAT Process



Perform label evaluations for new/modified hardware:

- **Labeling assessment** requires information on Label content, format, location and orientation. IPLAT performs 2 label evaluations: initial and final
 - Initial label evaluation
 - PowerPoint schematics with proposed labeling
 - Draft Engineering Drawings that contain all label details
 - Draft Engineering Drawings that contain label location/orientation info, and separate “label spec” (spreadsheet) with label content/format information. This method reduces changes to engineering drawings if/when label information is updated.
 - Final label evaluation
 - Released engineering drawings
 - Photos of flight hardware with labels installed. Vast majority of approvals are now done via photos.
- Note: A clear understanding of the payload’s operations is necessary in order to design labels that meet the requirements and facilitate on-orbit operations.



Standard IPLAT Process



- **IPLAT provides written feedback to PD:**
 - PD's proposed label design (meets requirements)
 - Or, provide detailed recommendations to meet requirements

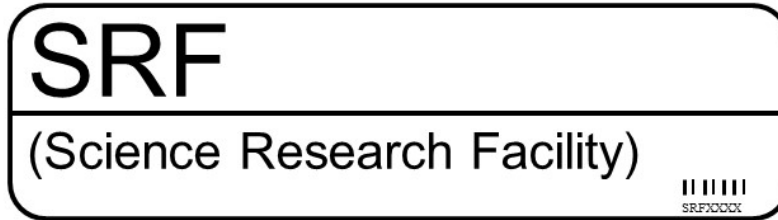
- **IPLAT provides required verification closure paperwork to PD:**
 - Signed 2994 form to close label verification

- **New for 2016:**
 - **eLabel will streamline the IPLAT label approval process. There will be a separate presentation on eLabel.**



Labeling Examples

(Identification, or “OpNom” labels)



Rack “main unit” name example



Rack “main unit” name example - vertical space limited



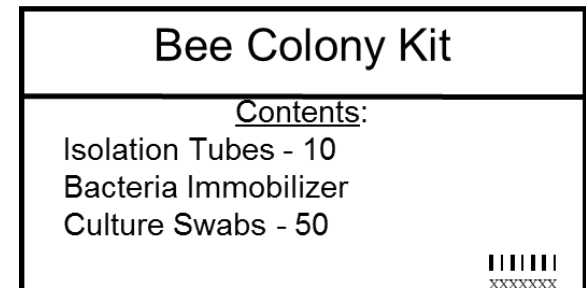
Subrack “main unit” name example



Example of “main unit” name for a
“Non-rack self-contained payload”



Example of subordinate
equipment name



Stowage kit name/contents label

Note 1: These standard labels can be ordered from the Decal Design & Production Facility (DDPF) through the BITS (Barcode Inventory Tracking System) group.

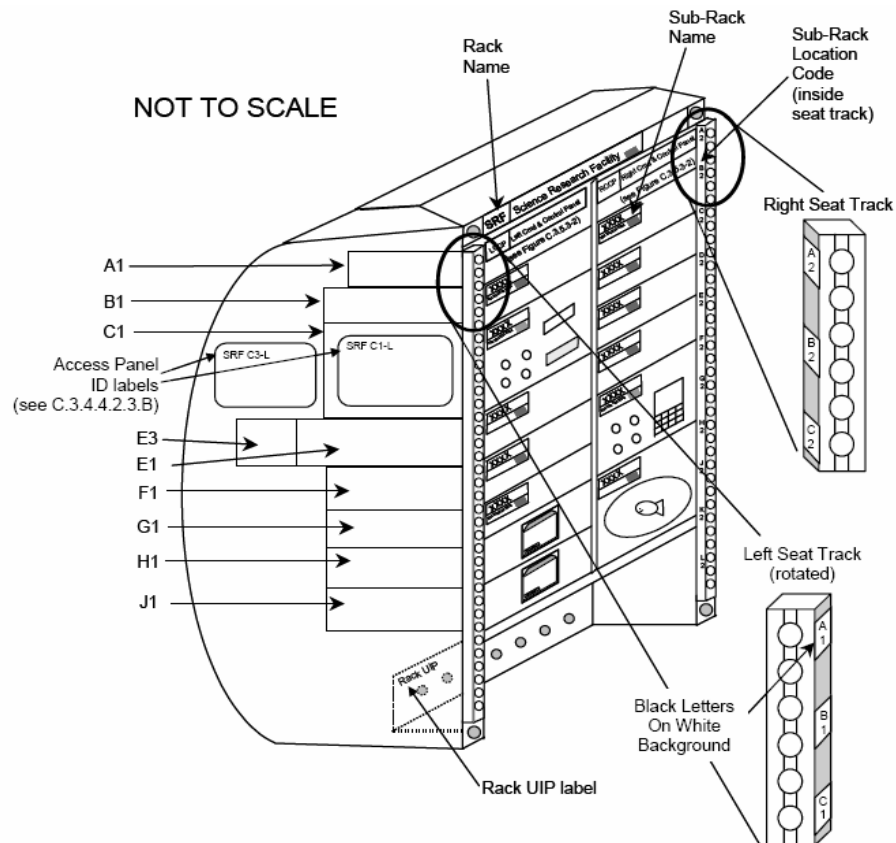
Note 2: Acronyms should be avoided when possible.

Note 3: To help denote ownership of an object to a specific payload, one can include the acronym in the “smart” barcode such as in the SRF examples above.



Labeling Examples (Rack and cable/hose labels)

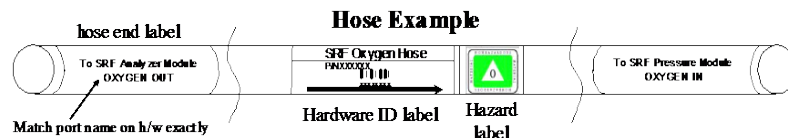
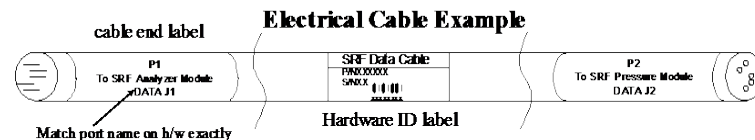
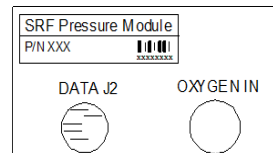
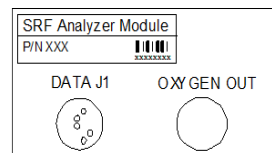
Rack level labeling



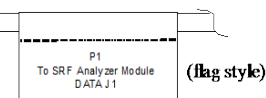
Connector port/cable & hose labeling

SCIENCE RESEARCH FACILITY (SRF)

NOT TO SCALE



Also acceptable:



Notes:

Electrical cables/ports: "P" designates cable end plugs and "J" designates receptacles on hardware regardless of gender (pins/sockets).

Hose End Labels: The first line of the end label may be left off (as shown above) if the hose end does not have a specific identifier. In this case, only the second and third lines are needed. If hose ends must be identified, do not use a "P" number.

Hose Identifying Labels: Flow direction should be shown if the hose ends are not interchangeable.



Labeling Examples (Stowage container labels)

Ziplock Example
(Not tracked)

Note: This is an example of an item that does not need to be tracked on orbit. The hardware can be labeled with an IMS barcode. If the item(s) will not be returned to the ziplock bag then only an identification label is used.

Ziplock Example
(Not tracked)

Note: This is an example of a small item(s) that does not need to be tracked on orbit. JF1345 Form (IMS Exemption) has been approved. If the item(s) will not be returned to the ziplock bag then only an identification label is used.

Ziplock Example
(Tracked)

Note: This is an example of a small item(s) that does need to be tracked on orbit because the hardware needs to be returned to the ziplock bag (ziplock is not thrown away). JF1345 Form (IMS Exemption) has been approved. The ziplock bag is manifested in this case and it should have a barcode on it. The part number for the ziplock itself is not necessary.

Kit Example
(Preferred)

Note: This is an example of stowage items that have been organized into a manifested kit.

Multiple Individually
Manifested Items Example
(Tracked)

Note: This is an example of a stowage items that have not been organized in a manifested kit. These stowage items need to be tracked on orbit because the hardware needs to be returned to the ziplock bag. If a ziplock bag is manifested in this case it should have a barcode on it, but the part number for the ziplock itself is not necessary because it's hardware inside that is relevant.

Multiple Individually
Manifested Items Example
(Not tracked)

Note: This is an example of stowage items that have not been organized into a manifested kit. These stowage items will not be returned to the ziplock bag.

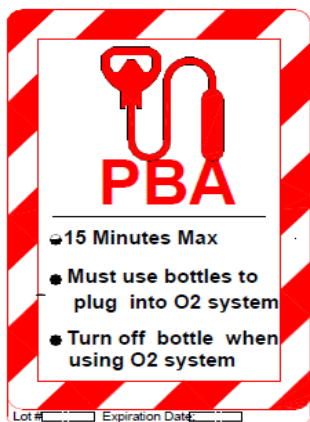


Labeling Examples

(Caution/Warning/Emergency Use labels)

Toxicology labels

Standard C&W labels



Emergency Use Label Example

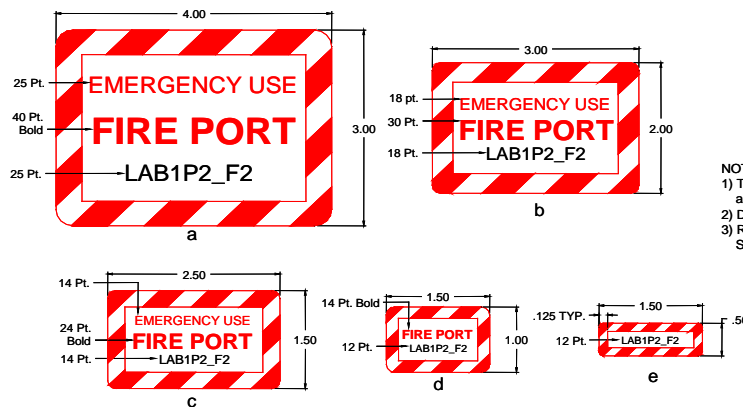


Caution/Warning Label Example



Toxic Hazard Label Examples

Fire port location code labeling



- NOTES:
- 1) Text is red & stripes are red/white
 - 2) Dimensions in inches
 - 3) Reference Drawing # SDG32108589



PD vs. IPLAT Responsibilities



Payload Developer Responsibilities:

- Contact IPLAT early in your design cycle
- Provide IPLAT with your HW development schedule, including design reviews, on-dock dates, etc.
- Notify IPLAT of any schedule changes
- Provide IPLAT with complete set of all label drawings/information
- Notify IPLAT if design or configuration changes are made, and for providing those updated drawings to IPLAT for review

IPLAT Responsibilities:

- Upon receipt of Engineering Drawings from PD, IPLAT will evaluate and respond to PD within 10 working days
 - Approval cycle begins when all of the drawings/information are received
 - IPLAT may negotiate for more time if the number of drawings is large or the payload is complex (many crew interfaces with labels)
- IPLAT will maintain a record of which drawings were reviewed and approved
- IPLAT will provide Label verification per agreed-to schedule, provided PD has met all above PD responsibilities



IPLAT Points of Contact



Payload IPLAT Lead

- Rich Ellenberger: 281.483.5238 (NASA FCI System Manager Deputy and Payload HF Lead)

Payload IPLAT Representatives

- David Segovia: 281.483.7566
- Antonius Widjokongko: 281.483.9717
- Wynona Johnson-McAfee: 281.483.8870
- Mai Lee Chang: 281.483.0685 (eLabel Database POC)

Other FCI Contacts:

- Laura Duvall: 281.483.0244



Questions ?

Thank you for your time